

Advancing Pennycress as Alternative Renewable Energy

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BIOFUELS AND AVIATION



4 billion gallons

United Airline's estimated annual jet fuel use. The U.S. commercial industry overall burns nearly 18 billion gallons. United and others are exploring the possibility of "drop-in" biofuels that could replace many of those gallons. In the Midwest alone, commercial aviation consumes nearly 3 billion gallons per year.

262 percent

The increase in crude oil prices from 2001-2012, impacting the airline's bottom line and passenger costs. Petroleum-based fuel now accounts for nearly 40 percent of an airline's total operating costs.

1,261

The current number of "mainline" and regional aircraft in United's jet fleet.

1,500-plus

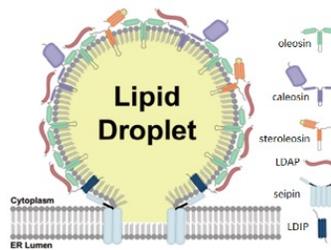
The number of biofuels-powered passenger flights that have been completed to date worldwide.

- The U.S. commercial industry uses 18 billion gallons per year.
- Crude oil prices increased by 262% in 10 years.
- Petroleum-based fuel accounts for 40% of the airline's operating costs.
- **Pennycress could be grown in 90 million-acre U.S. Midwest corn belt.**
- **Pennycress could produce up to 9 billion gallons of biodiesel per year.**

Improving Oil Storage & Stability in Pennycress

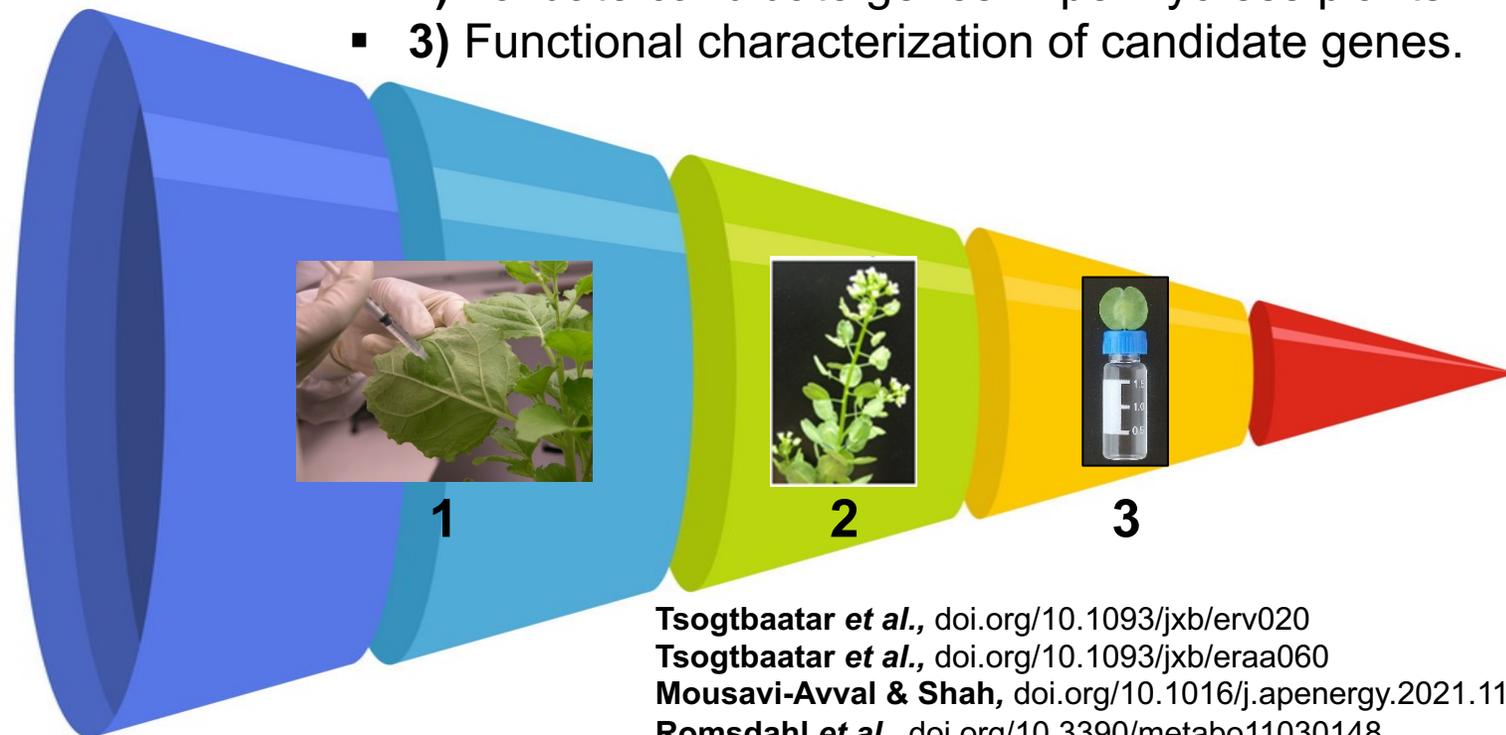
DOE-BER # DE-SC0019233

- 1) Investigating pennycress natural variation associated with oil accumulation
- 2) Identify targets



DOE-BER # DE-SC0020325

- 1) Screen candidate genes using transient expression in *N. benthamiana*
- 2) Validate candidate genes in pennycress plants
- 3) Functional characterization of candidate genes.

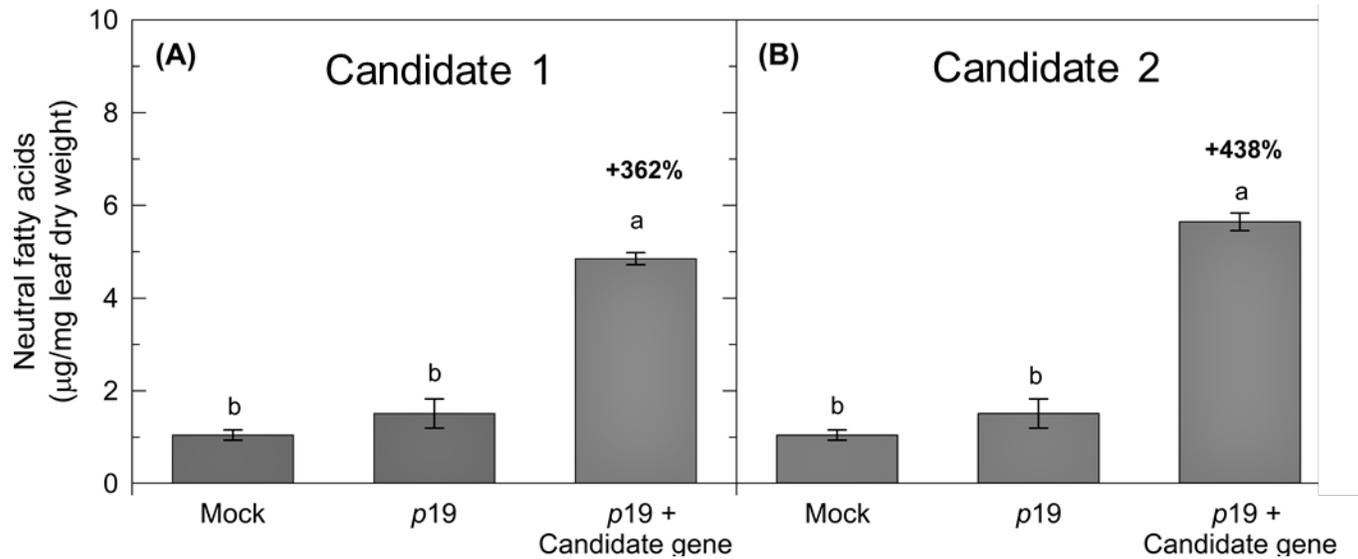


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Putative functional class	Number of genes		Total
	(+) correlated to LD formation	(-) correlated to LD formation	
Storage and packaging proteins	6	7	13
Lipid transfer proteins	1	6	7
Lipases	3	6	9
ER/endomembrane organization	1	1	2
Other (Unknown function)	2	2	4
Total	13	22	35

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Main outcomes



- ✓ 15 candidates were shown to increase lipid droplet formation and neutral FAs.
- ✓ These genes are being cloned and the generation of transgenic pennycress plants is in progress.
- ✓ We established time course labeling experiments to evaluate the temporal and spatial organization of storage lipids in developing pennycress seeds.



Future work

- ✓ This project is generating a set of mutants and tools that will boost the development of pennycress as a bioenergy crop.
- ✓ Design a novel route for catalytic conversion of pennycress oil, from wild-type and mutants, into alkanes.
- ✓ Establish the relation between the composition and physico-chemical characteristics of pennycress oil and its derived alkanes.